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(54) Abstract Title  
A child safety seat with moveable leg support

(57) An adjustable child safety car seat 19 comprising a back support 20 and a leg support 22. The leg support 22 is separate from and longitudinally movable relative to the back support 20. The distance from the back support 20 to the knee supporting edge 23, of the leg support 22, can be adjusted, by use of a gear mechanism, and locked into position in order to safely accommodate children having upper legs of differing lengths.

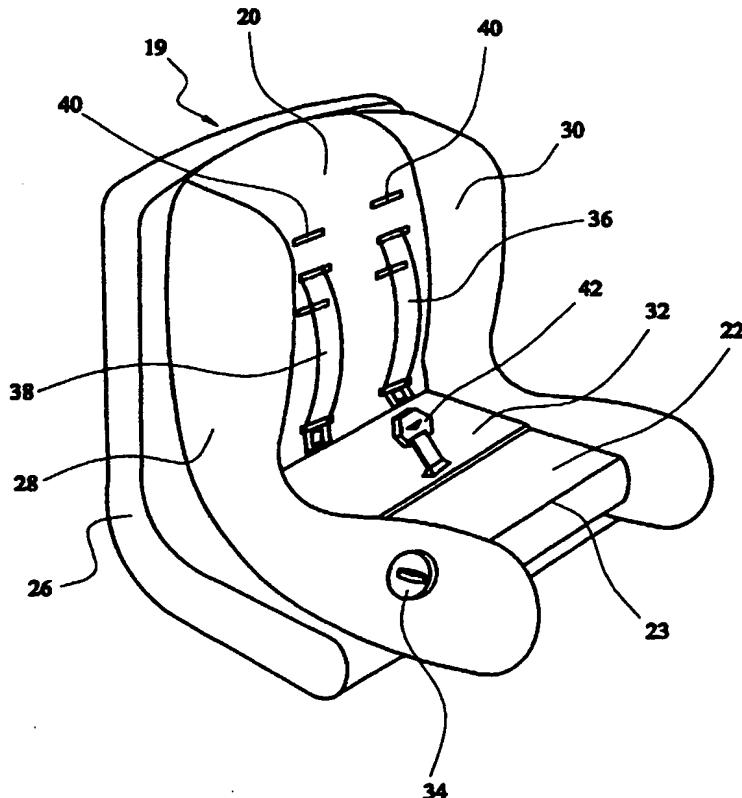


FIG. 3

At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

The claims were filed later than the filing date but within the period prescribed by Rule 25(1) of the Patents Rules 1995.

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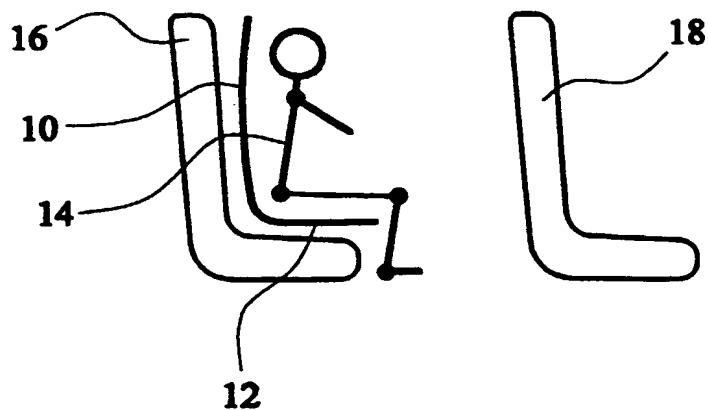


FIG. 1a

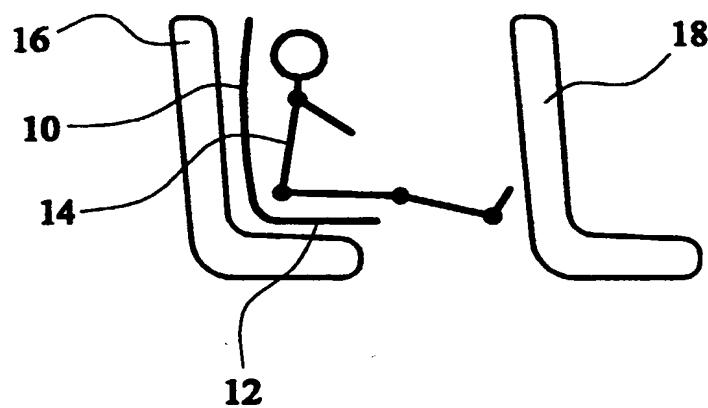


FIG. 1b

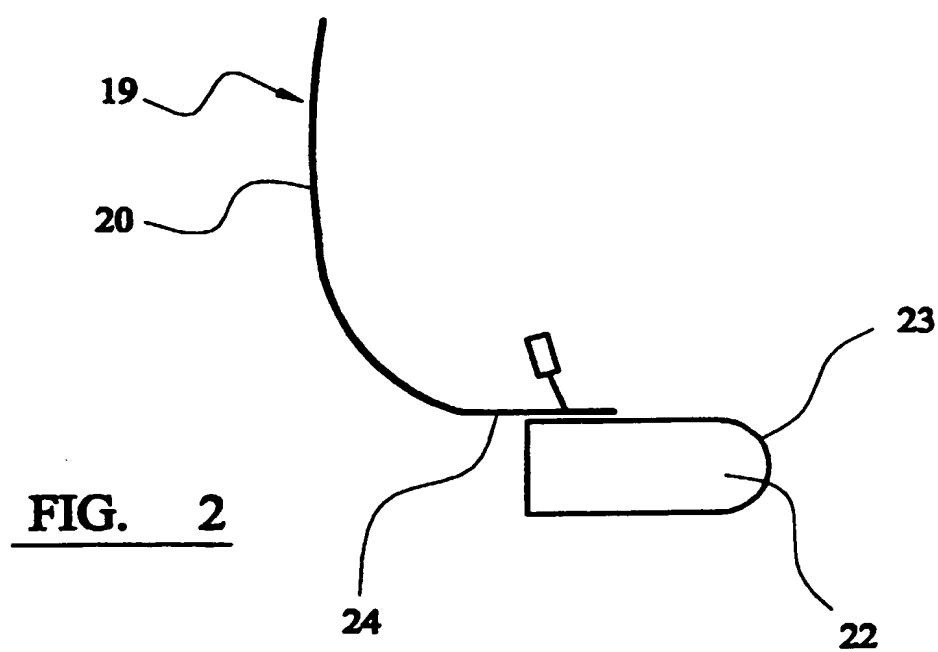


FIG. 2

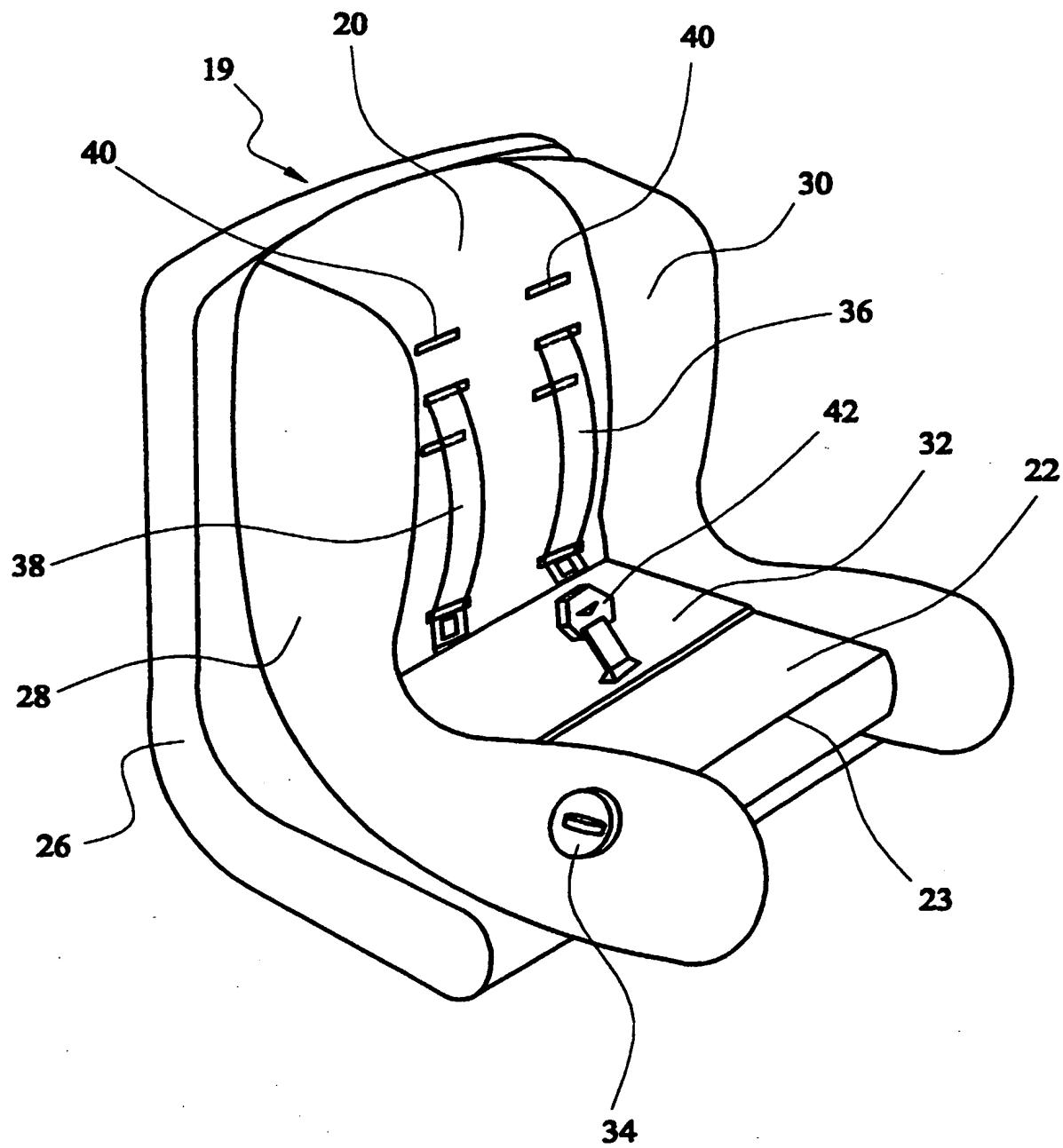


FIG. 3

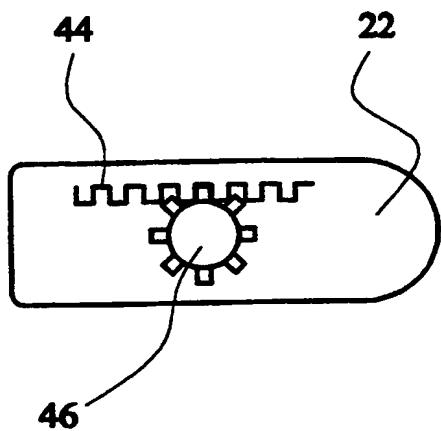


FIG. 4a

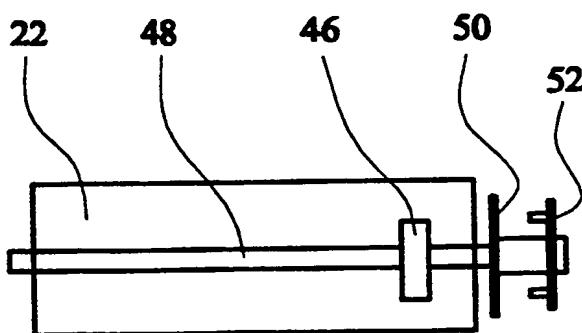


FIG. 4b

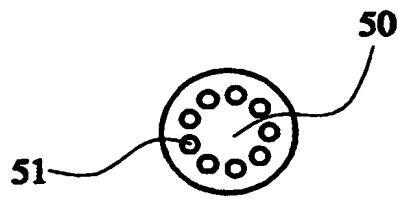


FIG. 4c

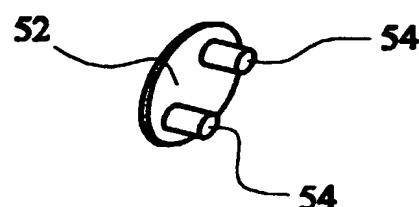


FIG. 4d

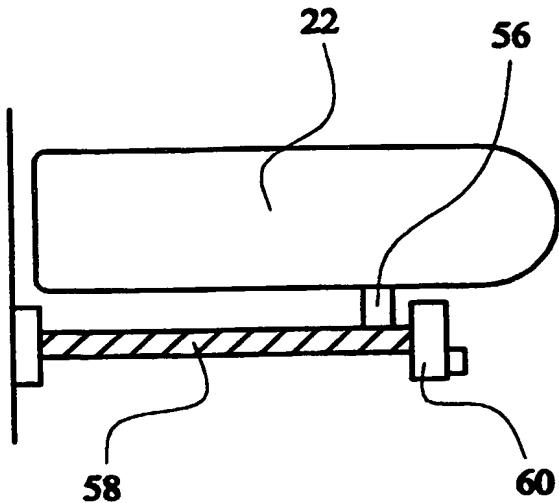


FIG. 5

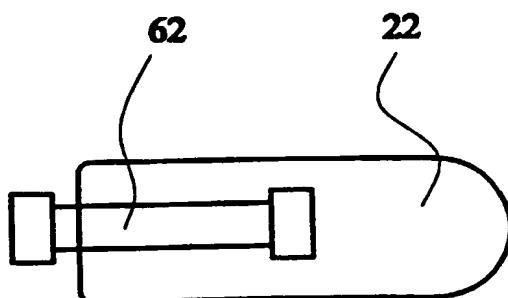


FIG. 6

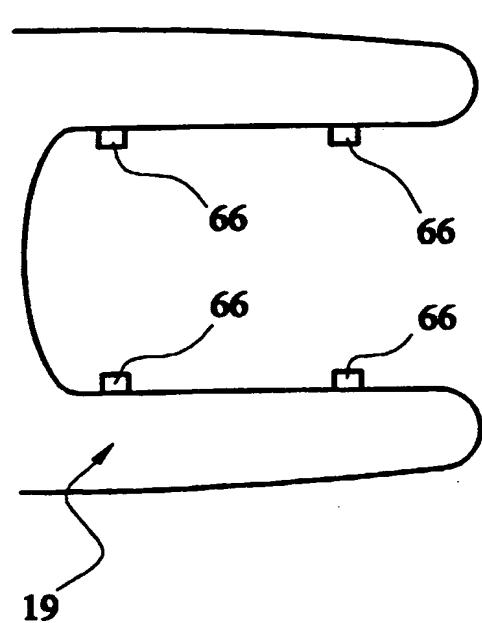
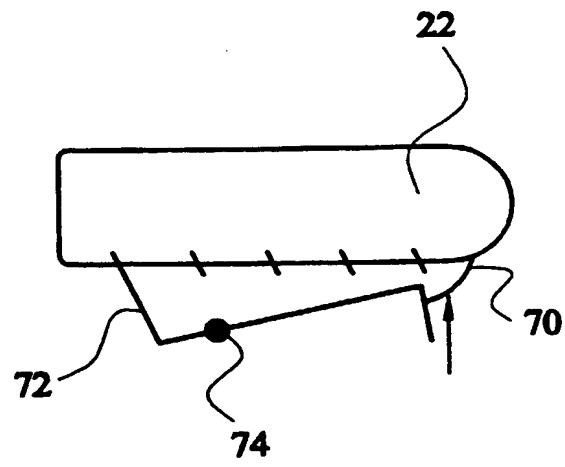
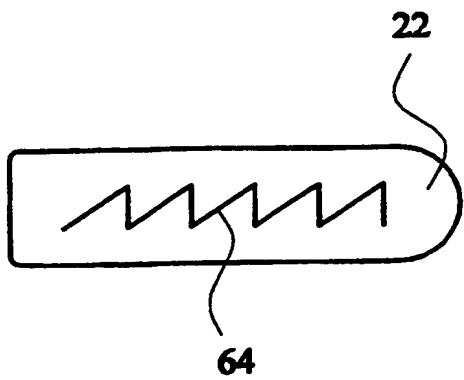


FIG. 7b

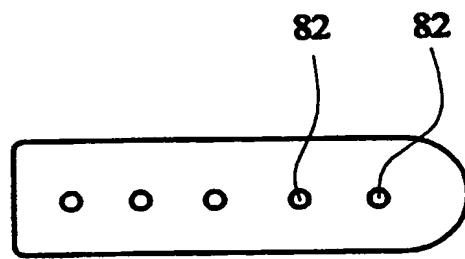


FIG. 9a

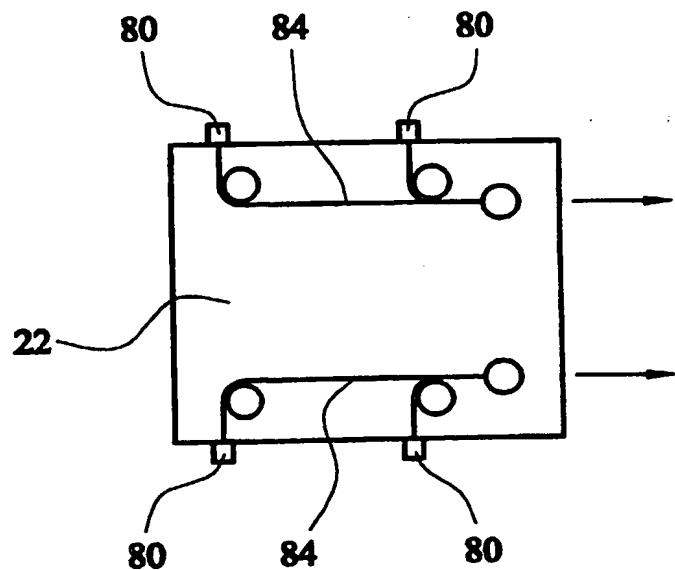


FIG. 9b

## CHILD SAFETY SEAT

Field of the Invention

5 The present invention relates to child safety seats, a method of restraining a child and especially, but not limited to, a child safety seat for a vehicle which is adjustable to restrain children of different sizes or for use as the child grows.

10

Background to the Invention

15 Children must be restrained within cars for their safety. Adult car seats and the accompanying seat belts are not suitable for use with children, especially young children. There are many prior car child seats which are arranged to be supported on the adult seat and held in position by the conventional seat belt. The child is then held in the child seat by further restraints. However, as 20 the child grows the child may not be restrained in a safe or comfortable position. At present, it may be necessary to change the child seat as the child grows since the child seat is only suitable for a particular size of child.

25

It is an aim of the present invention to overcome at least one problem associated with the prior art whether referred to herein or otherwise.

30 Summary of the Invention

According to a first aspect of the present invention there is provided a child safety seat comprising a back

support and a leg support wherein the leg support is movable between at least a first position and a second position relative to the back support, the seat comprising restraint means for restraining a child in the seat.

5

Preferably the child safety seat is a child safety car seat.

Preferably the leg support extends along a longitudinal axis relative to the back support. The longitudinal axis may be in the region of 90° to 130° relative to the back support and preferably is in the region of 95° to 110° relative to the back support. Preferably the leg support is movable along the longitudinal axis relative to the back support.

Preferably the child safety seat comprises a rear support section. The rear support section may, in use, support the rear of the child. The rear support section may support the majority of the weight of the child. The rear support section may be fixed relative to the back support. The rear support section may be integral with the back support section. The leg support section may be movable relative to the rear support. The rear support section may comprise a housing. The leg support may be extended from or retracted into the housing.

Preferably the leg support is locked in the first position. Preferably the leg support is locked in the second position.

The leg support may be slidably movable relative to the back support.

Preferably the leg support comprises a knee supporting edge. Preferably the distance from the knee supporting edge to the back support is adjustable to accommodate 5 children having different upper leg lengths.

Preferably the restraint means comprises at least one restraint which is arranged, in use, to restrain a child with the seat. The restraint means may comprise two 10 restraints. The or each restraint may be a shoulder restraint which is arranged, in use, to locate over the or each shoulder of the child. The height of the or each restraint relative to the back support may be adjustable. The length of the or each restraint may be adjustable.

15

The child safety seat may comprise a housing unit. The housing unit may comprise securing means for securing the child safety seat to a vehicle seat. Preferably the securing means comprises means for cooperating with the 20 restraining means provided by the vehicle and preferably the safety belt of the vehicle. The securing means may comprise apertures which enable the restraining means provided by the vehicle to pass therethrough.

25

Preferably the seat comprises lateral restraint members.

The leg support may be movable relative to the back support through a gear mechanism. The leg support may 30 have a rack secured thereto. The seat may have a gear wheel fixed relative to the back support. Preferably, rotation of the gear wheel causes translational movement

of the leg support relative to the back support. The gear wheel may be rotated through a child lock mechanism.

The leg support may be mounted on a threaded shaft.

5 The leg support may be movable along the threaded shaft.

The leg support may be movable by pneumatic or hydraulic means.

10 The leg support may have at least one toothed rail connected thereto. The or each toothed rail may selectively engage with pins in order to secure the leg support relative to the back support in a plurality of predetermined positions.

15

The leg support may be locked in position relative to the back support by a lever mechanism.

20 The leg support may comprise two portions. The leg support may comprise two laterally adjacent portions. Each lateral portion may be moved independently relative to the back support. Each lateral support may support a single leg.

25 According to a second aspect of the present invention there is provided an assembly comprising a vehicle, wherein the vehicle has a child safety seat in accordance with the first aspect of the present invention secured therein.

30

Preferably the child safety seat is located on a rear seat of the vehicle.

Preferably the child safety seat is secured to a seat of the vehicle by a safety belt provided by the vehicle.

Preferably the vehicle is a car.

5

According to a third aspect of the present invention there is provided a method of restraining a child in a vehicle comprising providing a child safety seat having a leg support and a back support, the method comprising 10 securing the child safety seat to a seat of the vehicle, moving the leg support relative to the back support between at least a first position and a second position and restraining the child in the child safety seat.

15 Preferably the method comprises sliding the leg support relative to the back support.

Preferably the method comprises moving the leg support relative to the back support along the longitudinal axis 20 of the leg support.

Preferably the method comprises unlocking the leg support in the first position. Preferably the method comprises locking the leg support in the second position.

25

Preferably the method comprises turning a gear wheel to move the leg support.

#### Brief Description of the Drawings

30

The present invention will now be described, by way of example only, with reference to the accompanying drawings, in which:

Figure 1a is a schematic side view of a car driver's seat and a rear child safety car seat.

5 Figure 1b is a schematic side view of a car driver's seat and a rear child safety car seat.

Figure 2 is a schematic side view of a child safety car seat.

10

Figure 3 is a perspective view of a child safety car seat.

15 Figure 4a is a schematic side view of a leg support for a child safety car seat.

Figure 4b is a lateral cross-section of a locking and moving mechanism for a leg support for a child safety car seat.

20

Figure 4c is a plan view of a part of a child lock mechanism for use with a moving mechanism for a leg support for a child safety car seat.

25

Figure 4d is a perspective view of a further part of a child lock mechanism for use with a moving mechanism for a leg support of a child safety car seat.

30

Figure 5 is a schematic side view of a leg support for a child safety seat.

Figure 6 is a schematic side view of a leg support for a child safety seat.

Figure 7a is a schematic side view of a leg support for a child safety seat.

5 Figure 7b is a plan view of a retainer for a leg support for a child safety seat.

Figure 8 is a schematic side view of a leg support for a child safety seat.

10

Figure 9a is a schematic side view of a part of a child safety seat.

15

Figure 9b is a schematic plan view of a leg support for a child safety seat.

#### Description of the preferred embodiments

A shown in Figure 1a, a child safety car seat generally comprises a seat unit comprising a back support 10 and a leg support 12 in order to provide a seat for a child 14. The seat unit is supported on the normal car seat 16 in the rear of the car. The seat unit is secured to the car seat 16 by the use of restraining means which comprise the conventional safety belt (seat belt) provided in the car. Accordingly, the seat unit means that the child is in a safer and more comfortable position relative to being seated on the normal car seat. However, unless the seat unit is the correct size for the child then the child may be seated in a dangerous position, as shown in Figure 1b. If the child's upper legs are not long enough for the seat unit then the child's legs may not be able to bend and hang down from the seat. In this situation the

child's legs are extended towards the back of the front seats 18. In the event of an accident, the front seats may move backwards and the child may move forwards. In such a situation the force from the front seats may be 5 transmitted through the child's extended legs which may not have been the case if the child's legs were hanging down from the seat unit. In addition, the child's legs may be extended to such an extent that normally they abut the back of the driver's seat. This can be an irritation 10 for the driver especially on long journeys. In addition, the child may be sat in an incorrect position which may encourage the child to develop a bad posture.

An adjustable child safety car seat 19 comprises a 15 back support 20 which is arranged to support the back of the child and a leg support 22 which is arranged to at least partially support the legs of the child, as shown in Figure 2. The leg support 22 is separate from the back support 20 and is longitudinally movable relative to the 20 back support. Accordingly, the distance from the back support to the knee supporting edge 23 of the leg support can be adjusted in order to safely accommodate children having upper legs of differing lengths. For example, the leg support 22 may be moved away from the back support 20 25 in order to accommodate a large child and the leg support 22 may be moved towards the back support 20 in order to safely accommodate a smaller child. In addition, the same seat can be used for a child as they grow rather than larger seats having to be purchased as the child grows up, 30 for example a single adjustable child safety seat may be used safely for a child from 1 year old to 5 years old.

The adjustable child safety seat 19 is secured to the normal car seats using a conventional seat belt (not shown), and preferably by a conventional three point seat belt. The adjustable child safety seat comprises a 5 housing unit or body 26 which generally comprises a substantially vertical portion and a substantially horizontal portion generally perpendicular to each other, as shown in Figure 3. The body 26 provides the anchor portions in order for the adjustable child safety seat to 10 be secured to the car seat. The body 26 comprises a substantially rigid material.

The adjustable child safety seat 19 has two lateral supports 28, 30 in order to laterally support the child 15 within the seat. Again, the lateral supports 28, 30 comprise a substantially rigid material although resilient padding may be included on the internal faces for the comfort of the child.

20 The adjustable child safety seat 19 has a back support 20 and a leg support 22 having a knee supporting edge 23. As previously mentioned, the leg support 22 is movable relative to the back support 20. The adjustable child safety seat 19 has a rear support section 32 which does 25 not move relative to the back support 20. The rear support section 32 provides a housing whereby the leg support can be extended from or retracted into. The movement of the leg support may be manually controlled and a dial 34 and the mechanism for moving the support will be 30 described later.

The leg support 22 extends away from the back support 20 along the longitudinal axis of the leg support 22. The

back support 20 may be slightly reclined and the angle between the back support 20 and the leg support 22 may be in the region of 95° to 110°.

5        The adjustable child safety seat 19 has restraints 36, 38 in order to restrain the child within the seat. The restraints 36, 38 are fixed to the body 26 and pass through apertures 40 provided in the back support 20. The two restraints 36, 38 secure over the child's shoulders  
10 and secure within a locking housing 42 secured to the rear support 32 and located in between the legs of the child. The restraints 36, 38 lock in the housing using conventional apparatus. A series of apertures 40 are provided in the back support in order for the restraints  
15 to be located at different vertical levels in order for the restraints 36, 38 to be located at the correct height for the height of the child. The lengths of the restraints 36, 38 are also adjustable.

20       The leg support 22 may be extended from or retracted into the housing of the rear section 32 using a gear mechanism, as shown in Figure 4a. The leg support 22 has a rack 44 secured thereto. A gear wheel 46 is engaged with the rack 44. As the gear wheel 46 is rotated the  
25 rack 44 and, therefore, the leg support 22 will move relative to the gear wheel 46. Accordingly, the gear wheel is fixed relative to the back support 20 in order for the leg support 22 to move relative to the back support 20.

30

      The gear wheel 46 is mounted on an axle 48, as shown in Figure 4b. The gear wheel 46 is protected by a child safety catch such that a child cannot easily move the leg

support 22 and, also, no inadvertent movement of the leg support 22 will occur. The child safety catch comprises two discs 50, 52 spaced apart on the axle 48. The first disc 50 comprises a plurality of apertures 51 located adjacent to its periphery, as shown in Figure 4c. The second disc 52 comprises two engagement members 54 projecting from the face of the second disc 52 facing the first disc 50. The first disc 50 is fixed relative to the axle 48 on which the gear wheel 46 is fixed. However, the second disc 52 is free to rotate and the second disc 52 does not rotate the axle 48 whereas rotation of the first disc 50 does rotate both the axle 48 and the gear wheel 46. The second disc 52 is longitudinally movable along the axle relative to the first disc 50. Therefore, in use, the second disc 52 is pushed towards the first disc 50 and is rotated until the two engagement members 54 engage within the apertures provided in the first disc 50. Thereafter, movement of the second disc 52 causes movement of the first disc 50 and, therefore, moves the leg support 22. The first disc 50 may be shrouded so that the first disc 50 cannot be rotated directly. In addition, the second disc 52 may be urged away from the first disc 50 such that a reasonable force is required in order for the second disc 52 to be moved towards the first disc 50. The mechanism may comprise two means for rotating the axle 48 which may be located adjacent to both longitudinal ends of the axle 48.

Alternatively, the leg support 22 may be supported on a mounting 56 whereby the mounting is engaged on a threaded shaft 58, as shown in Figure 5. Accordingly, rotation of a handle 60 causes the mounting 56 and,

thereby the leg support 22 to move relative to the back support 20 to which the threaded shaft 58 is fixed.

5 In a further embodiment, the leg support 22 may be mounted on an extending member 62, as shown in Figure 6. The extending member 62 may be pneumatically or hydraulically operated and can be extended or retracted relative to the back support.

10 15 In another embodiment, the leg support 22 may have two rails 64 secured thereto, as shown in Figure 7a. Each rail 64 provides a toothed surface. The leg support 22 is supported in the seat by securing pins 66 projecting inwardly from the seat. The pins 66 locate in the peaks provided by the toothed rails 64. The toothed rails 64 may be arranged such that the leg support can be easily extended by sliding the toothed rails over the pins 66 but only retracted by lifting the toothed rails above the pins 66 before moving the leg support 22.

20

In yet another embodiment, the leg support may be locked in position by a lever mechanism as shown in Figure 8. A lever comprising a handle section 70 and an engagement member 72 is pivoted about a pivot 74 located 25 therebetween. The end of the engagement member 72 locates within openings provided in the leg support 22 in order to lock the leg support 22 in position. However, in the handle section 70 is moved upwardly, the end of the engagement member withdraws from the opening and enables 30 the leg support 22 to be moved. The leg support can then be locked back in position by locating the end of the engagement member 72 in another opening. This mechanism

only provides a number of predetermined positions for the leg support 22 relative to the back support 20.

Finally, the leg support 22 may be locked in position 5 by a cable mechanism, as shown in Figure 9a and Figure 9b. The cable mechanism has two pegs 80 projecting outwardly from the lateral sides of the leg support 22. The pegs 80 are able to extend from the leg support 22 or be retracted into the leg support 22. The seat has a plurality of 10 engagement apertures 82 defined therein on inwardly facing walls which are located adjacent to the lateral sides of the leg support 22. The pegs 80 engage within the engagement apertures in order to secure the leg support 22 relative to the seat and hence the back support. The pegs 15 80 have resilient means or springs which urge the pegs 80 to project outwardly. However, an inner part of the pegs 80 is attached to a cable 84. If the cable 84 is pulled, this will result in the pegs 80 retracting into the leg support 22. In addition, if the cable 84 is released then 20 the pegs will project outwardly from the leg support 22. Accordingly, in use, the cables 84 are pulled in order for the pegs 80 to withdraw from the engagement apertures 82 and retract into the leg support 22. The leg support 22 can then be moved relative to the seat. The cables 84 can 25 then be released in order for the pegs to be urged outwardly from the leg support 22. The leg support 22 may be needed to be moved slightly in order for the pegs 80 to engage within corresponding engagement apertures 82.

30 In a further embodiment, the leg support may comprise two laterally adjacent portions. Each portion may be moved independently relative to the back support. Accordingly, each portion may comprise a movement

mechanism which may be similar to those described above. The advantage of such a feature is that if the leg support is fully adjustable for each leg. For example, a disabled child may require their legs to be supported at different 5 distances from the back support. This may also be advantageous for children in which one leg is longer than the other leg.

The movement mechanism may have indication means to 10 indicate the position of the leg support 22 relative to the back support 20 for an individual child. For example, indicators may show the separate positions of the leg support 22 for at least one child in case the leg support needs to be moved to accommodate another child. The 15 indicator would then enable the leg support 22 to be quickly and accurately returned to the correct position for the relevant child.

The reader's attention is directed to all papers and 20 documents which are filed concurrently with or previous to this specification in connection with this application and which are open to public inspection with this specification, and the contents of all such papers and documents are incorporated herein by reference.

25

All of the features disclosed in this specification (including any accompanying claims, abstract and drawings), and/or all of the steps of any method or process so disclosed, may be combined in any combination, 30 except combinations where at least some of such features and/or steps are mutually exclusive.

Each feature disclosed in this specification (including any accompanying claims, abstract and drawings), may be replaced by alternative features serving the same, equivalent or similar purpose, unless expressly 5 stated otherwise. Thus, unless expressly stated otherwise, each feature disclosed is one example only of a generic series of equivalent or similar features.

10 The invention is not restricted to the details of the foregoing embodiment(s). The invention extend to any novel one, or any novel combination, of the features disclosed in this specification (including any accompanying claims, abstract and drawings), or to any novel one, or any novel combination, of the steps of any method or process so 15 disclosed.

Claims

1. A child safety seat comprising a back support and a leg support wherein the leg support is movable between at 5 least a first position and a second position relative to the back support, the seat comprising restraint means for restraining a child in the seat.
2. A child safety seat according to claim 1 in which the 10 child safety seat is a child safety car seat.
3. A child safety seat according to claim 1 or claim 2 in which the leg support extends along a longitudinal axis relative to the back support.

15

4. A child safety seat according to claim 3 in which the longitudinal axis is in the region of 90° to 130° relative to the back support.
- 20 5. A child safety seat according to any preceding claim in which the child safety seat comprises a rear support section.
- 25 6. A child safety seat according to claim 5 in which the rear support section, in use, supports the rear of the child.
- 30 7. A child safety seat according to claim 5 or claim 6 in which the rear support section is fixed relative to the back support.
8. A child safety seat according to any preceding claim in which the leg support is locked in the first position.

9. A child safety seat according to any preceding claim in which the leg support is locked in the second position.

5 10. A child safety seat according to any preceding claim in which the leg support is slidably movable relative to the back support.

10 11. A child safety seat according to any preceding claim in which the leg support comprises a knee supporting edge.

12. A child safety seat according to claim 11 in which the distance from the knee supporting edge to the back support is adjustable to accommodate children having different 15 upper leg lengths.

13. A child safety seat according to any preceding claim in which the restraint means comprises at least one restraint which is arranged, in use, to restrain a child 20 in the seat.

14. A child safety seat according to any preceding claim in which the child safety seat comprises a housing unit.

25 15. A child safety seat according to claim 14 in which the housing unit comprises securing means for securing the child safety seat to a vehicle seat.

30 16. A child safety seat according to any preceding claim in which the seat comprises lockable restraint members.

17. A child safety seat according to any preceding claim in which the leg support is movable relative to the back support through a gear mechanism.
- 5 18. A child safety seat according to any preceding claim in which the leg support is mounted on a threaded shaft.
- 10 19. A child safety seat according to any preceding claim in which the leg support has at least one toothed rail connected thereto.
20. A child safety seat according to any preceding claim in which the leg support comprises two portions.
- 15 21. A child safety seat according to claim 20 in which the leg support comprises two laterally adjacent portions.
- 20 22. A child safety seat according to claim 21 in which each lateral portion is movable independently relative to the back support.
23. A child safety seat according to claim 21 or claim 22 in which each lateral support supports a single leg.
- 25 24. An assembly comprising a vehicle, wherein the vehicle has a child safety seat according to any preceding claim secured therein.
- 30 25. An assembly according to claim 24 in which the child safety seat is located on a rear seat of the vehicle.

26. An assembly according to claim 24 or claim 25 in which the child safety seat is secured to a seat of the vehicle by a safety belt provided by the vehicle.

5 27. A method of restraining a child in a vehicle comprising providing a child safety seat having a leg support and a back support, the method comprising securing the child safety seat to a seat of the vehicle, moving the leg support relative to the back support between at least 10 a first position and a second position and restraining the child in the child safety seat.

28. A method according to claim 27 comprising sliding the leg support relative to the back support.

15 29. A method according to claim 27 or claim 28 comprising moving the leg support relative to the back support along the longitudinal axis of the leg support.

20 30. A method according to any one of claims 27 to 29 comprising locking the leg support in the first position.

31. A method according to any one of claims 27 to 30 comprising locking the leg support in the second position.

25 32. A method according to any one of claims 27 to 32 comprising turning a gear wheel to move the leg support.

30 33. A child safety seat substantially as herein described, with reference to, and as shown in any of the accompanying drawings.

34. An assembly substantially as herein described with reference to, and as shown in any of the accompanying drawings.

5 35. A method of restraining a child in a vehicle substantially described with reference to, and as shown in any of the accompanying drawings.



INVESTOR IN PEOPLE

**Application No:** GB 0021352.0  
**Claims searched:** 1 to 35

**Examiner:** Dean Parry  
**Date of search:** 28 November 2001

## Patents Act 1977

### Search Report under Section 17

#### Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.S): A4L (LBMA, LCC)

Int Cl (Ed.7): B60N (2/02, 2/26, 2/62)

Other: Online: EPODOC WPI JAPIO

#### Documents considered to be relevant:

Category	Identity of document and relevant passage		Relevant to claims
Y	GB 2342288 A	(LEMMEYER) see fig 1.	1 to 13, 16, 20, 21, and 24 to 31.
A	DE 19943707 A	(BROSE FAHRZEUGTEILE) see figs and WPI abstract.	
A	DE 19628381 A	(FAURE SITZTECHNIK) see figs and WPI abstract.	
Y	DE 4140638 A	(WUERSTL VERMOEGENSVERWALT) see figs 1 and 2, and WPI abstract.	1 to 13, 16, 20, 21, and 24 to 31.
A	US 4541669 A	(GOLDNER) see figs and abstract.	

X Document indicating lack of novelty or inventive step  
Y Document indicating lack of inventive step if combined with one or more other documents of same category.  
& Member of the same patent family

A Document indicating technological background and/or state of the art.  
P Document published on or after the declared priority date but before the filing date of this invention.  
E Patent document published on or after, but with priority date earlier than, the filing date of this application.